Fig. 1

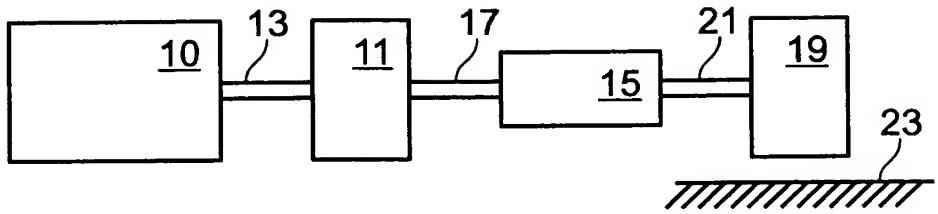

10
13
11
17
15
21
19
23

Fig. 3A

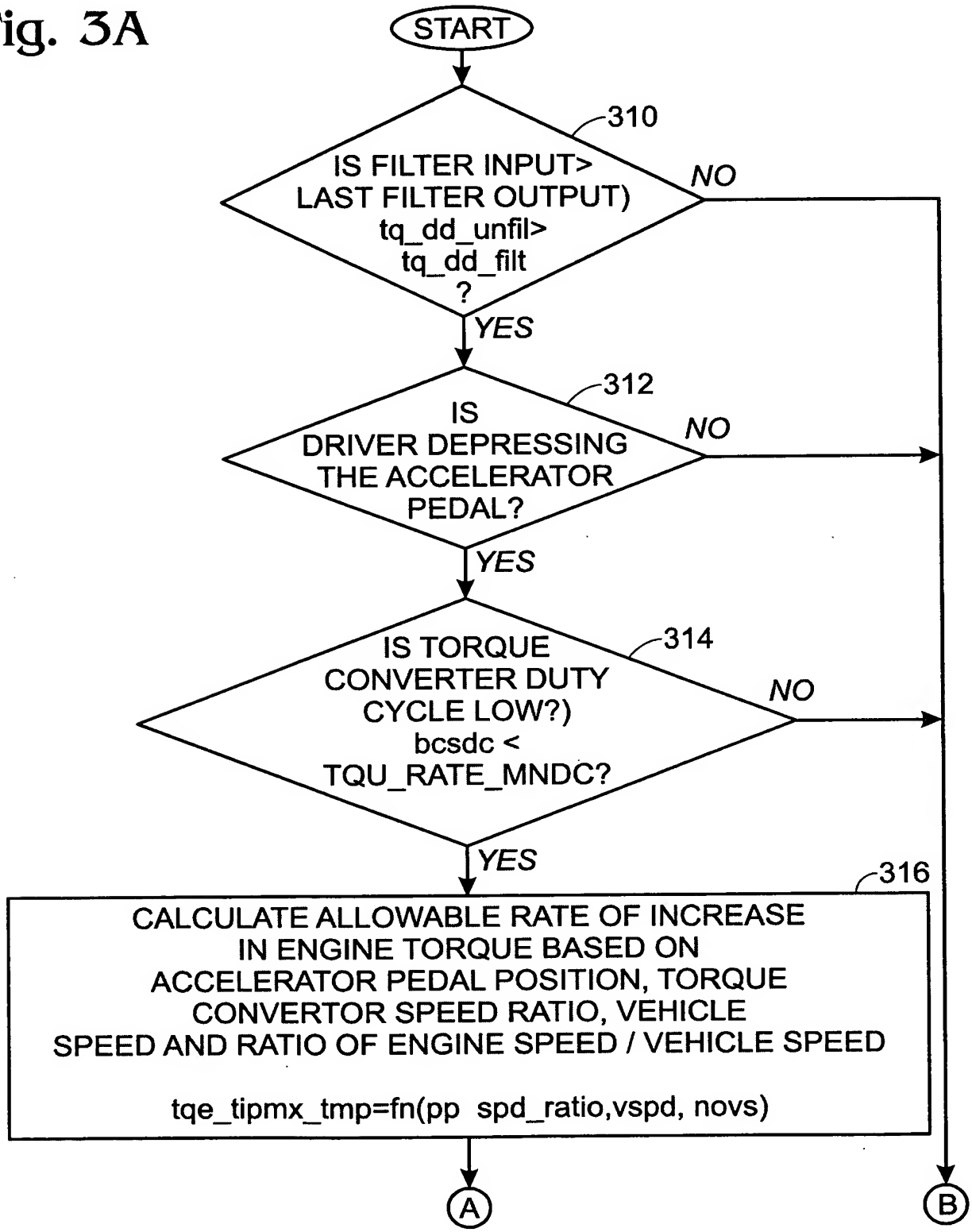

START
310
IS FILTER INPUT> LAST FILTER OUTPUT) tq_dd_unfil> tq_dd_filt ?
NO
YES
312
IS DRIVER DEPRESSING THE ACCELERATOR PEDAL?
NO
YES
314
IS TORQUE CONVERTER DUTY CYCLE LOW?) bcsdc < TQU_RATE_MNDC?
NO
YES
316
CALCULATE ALLOWABLE RATE OF INCREASE IN ENGINE TORQUE BASED ON ACCELERATOR PEDAL POSITION, TORQUE CONVERTOR SPEED RATIO, VEHICLE SPEED AND RATIO OF ENGINE SPEED / VEHICLE SPEED
tqe_tipmx_tmp=fn(pp spd_ratio,vspd, novs)
A
B

Fig. 3B

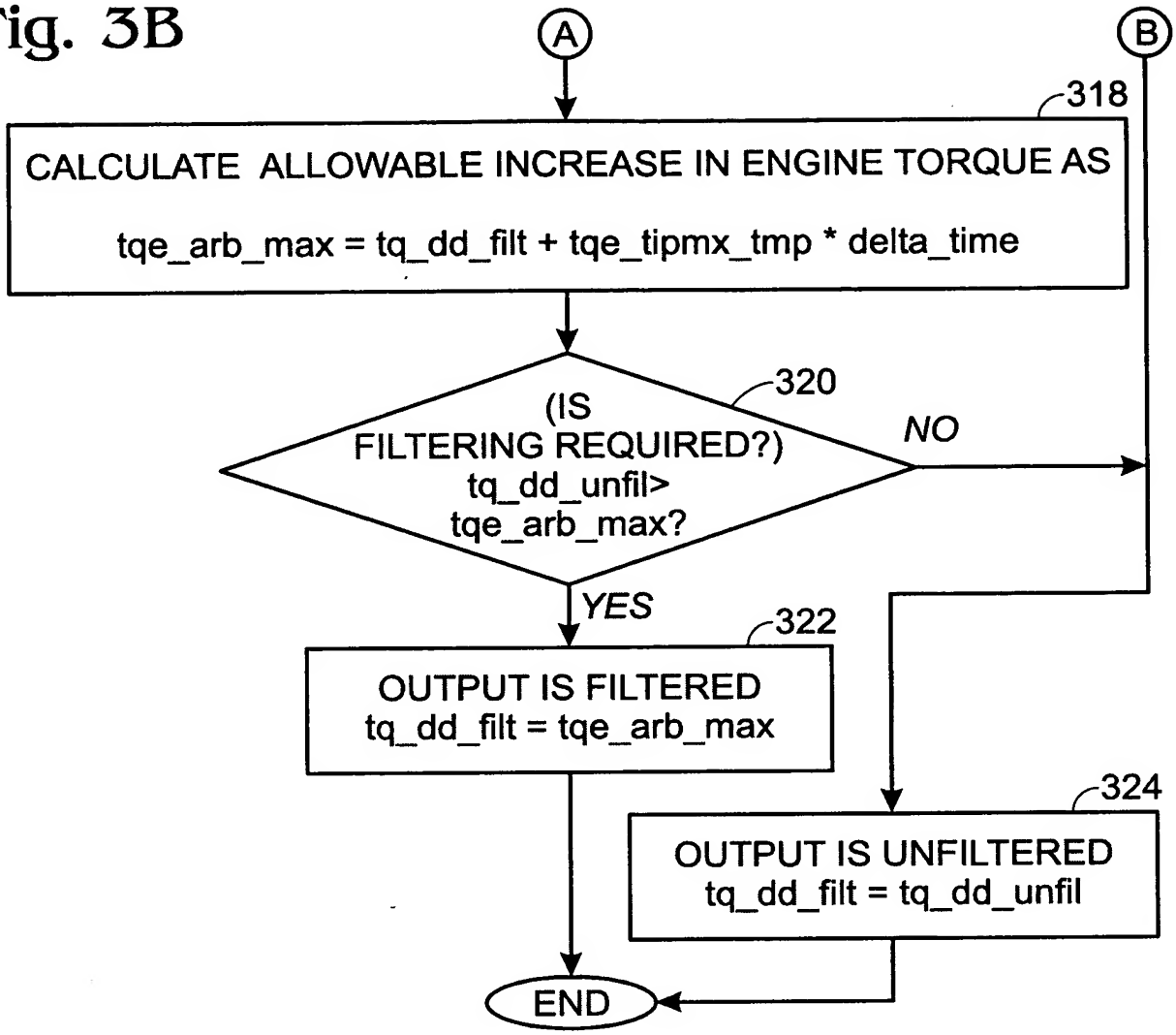
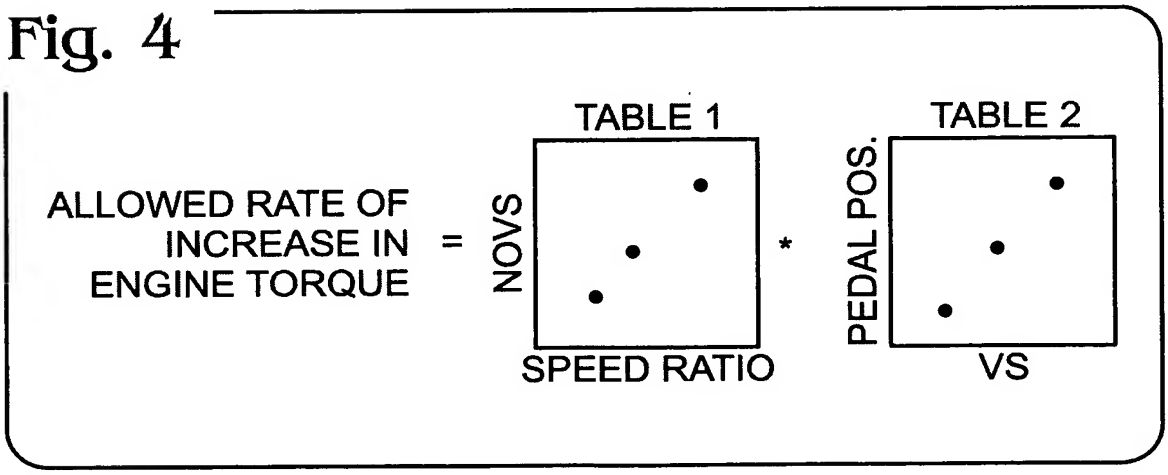

A
B
318
CALCULATE ALLOWABLE INCREASE IN ENGINE TORQUE AS
tqe_arb_max = tq_dd_filt + tqe_tipmx_tmp * delta_time
320
(IS FILTERING REQUIRED?)
tq_dd_unfil> tqe_arb_max?
NO
YES
322
OUTPUT IS FILTERED
tq_dd_filt = tqe_arb_max
324
OUTPUT IS UNFILTERED
tq_dd_filt = tq_dd_unfil
END

Fig. 4


ALLOWED RATE OF INCREASE IN ENGINE TORQUE
=
TABLE 1
NOVS
SPEED RATIO
*
TABLE 2
PEDAL POS.
VS

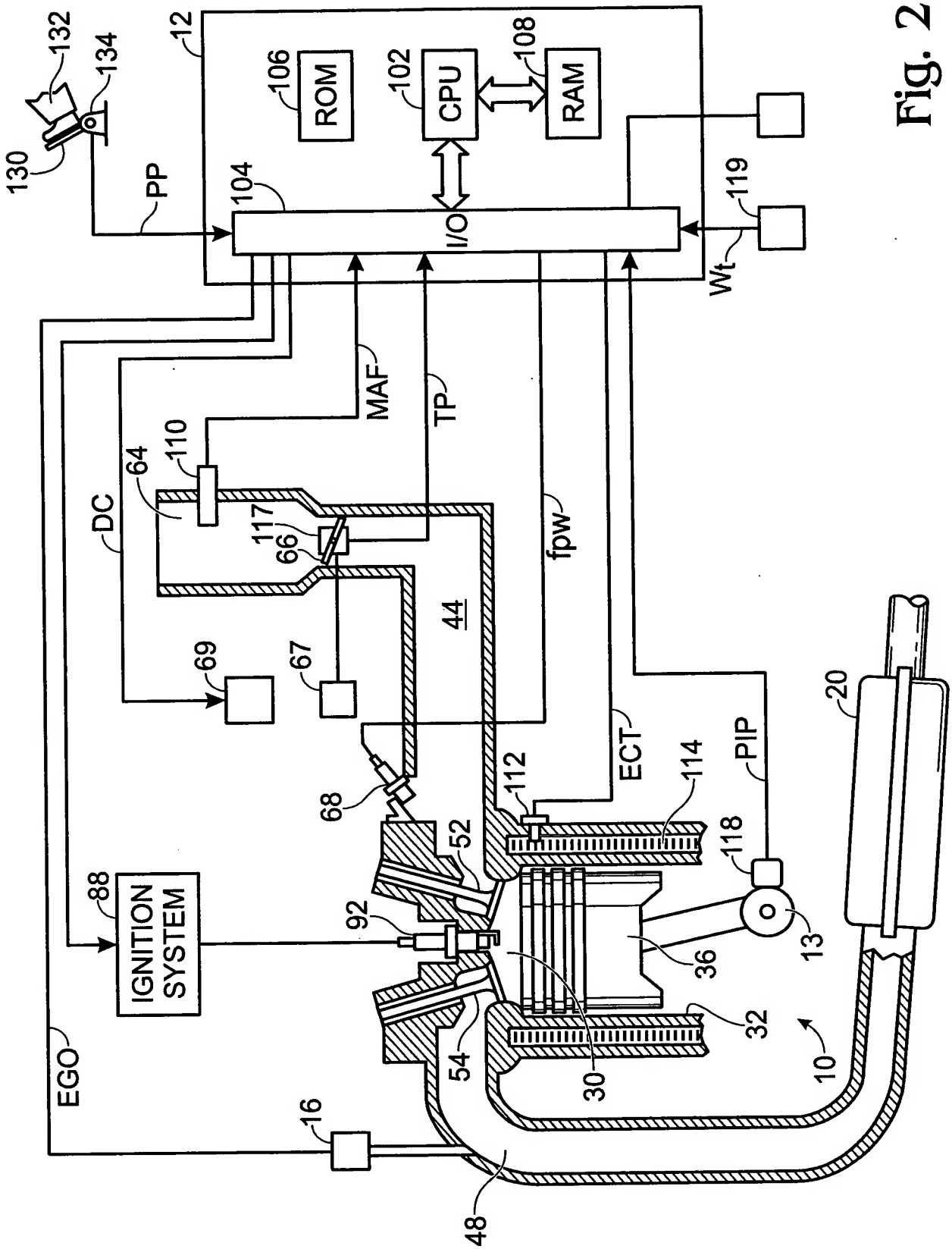

12
ROM
106
CPU
102
RAM
108
I/O
104
PP
130
132
134
119
Wt
MAF
TP
fpw
ECT
PIP
64
110
DC
117
66
44
69
67
68
112
114
52
118
88
IGNITION SYSTEM
92
36
13
32
54
30
10
20
EGO
16
48

Fig. 2

Fig. 5

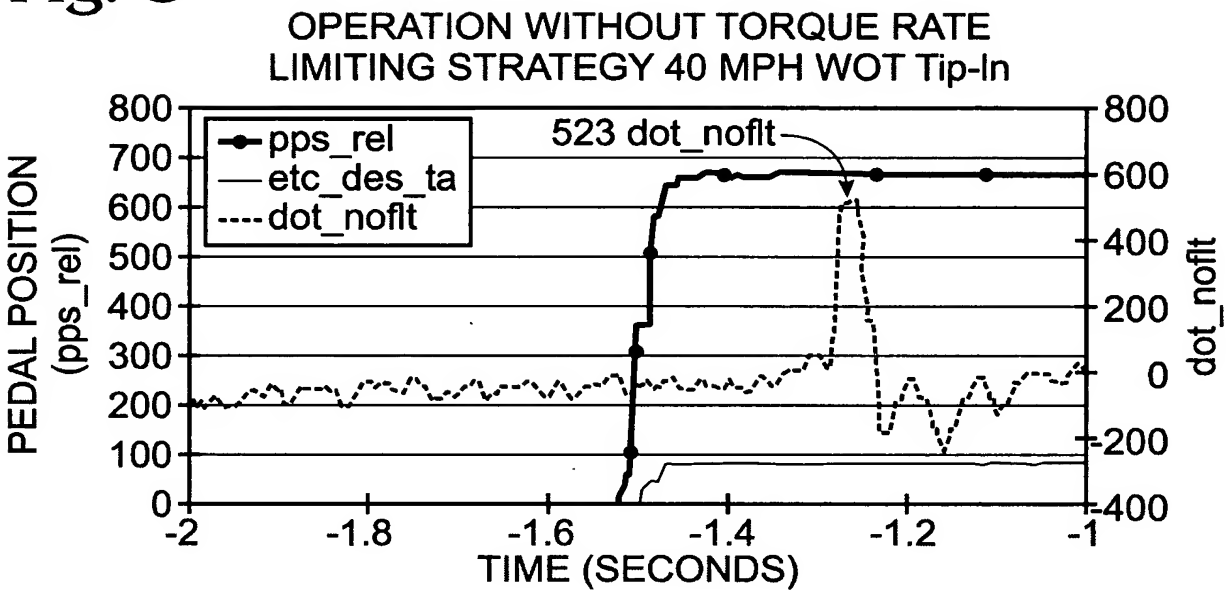

OPERATION WITHOUT TORQUE RATE
LIMITING STRATEGY 40 MPH WOT Tip-In
PEDAL POSITION (pps_rel)
dot_noflt
TIME (SECONDS)
pps_rel
etc_des_ta
dot_noflt
523 dot_noflt
800
700
600
500
400
300
200
100
0
-200
-400
-2
-1.8
-1.6
-1.4
-1.2
-1

Fig. 6

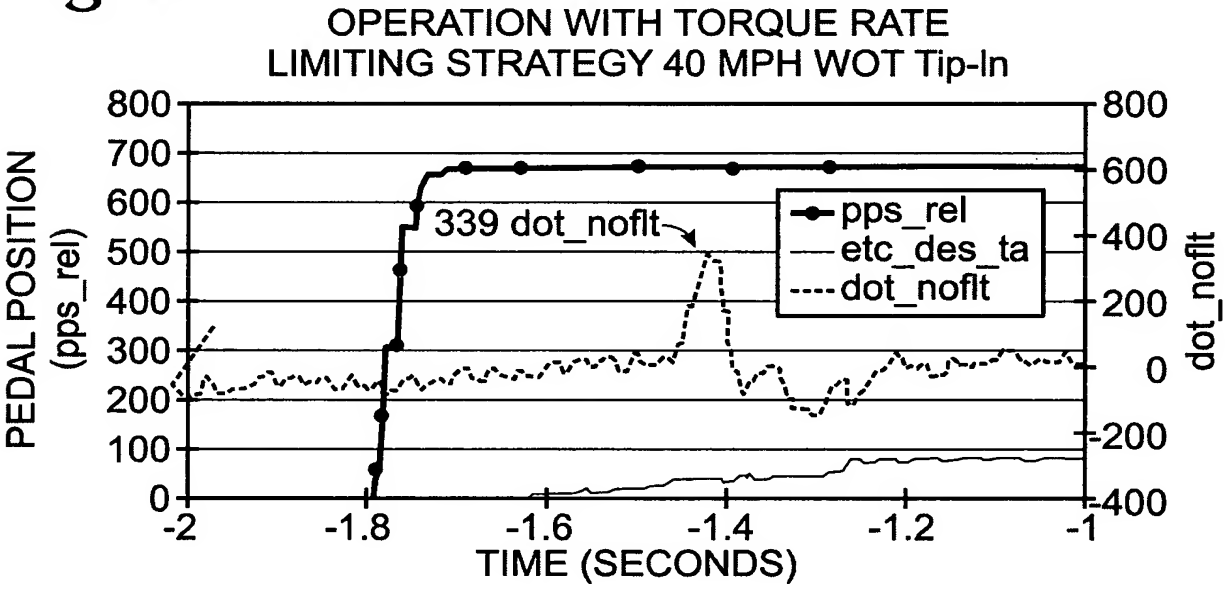

OPERATION WITH TORQUE RATE
LIMITING STRATEGY 40 MPH WOT Tip-In
PEDAL POSITION (pps_rel)
dot_noflt
TIME (SECONDS)
pps_rel
etc_des_ta
dot_noflt
339 dot_noflt
800
700
600
500
400
300
200
100
0
-200
-400
-2
-1.8
-1.6
-1.4
-1.2
-1

Fig. 7

Example Embodiment of Computer Code

Terms	Units	Definition
app	flag	-1=foot off accel pedal, 0=part pedal, 1=max pedal
bcsdc	fraction	torque converter bypass clutch duty cycle
TQE_RATE_MNDC	unitless	threshold of duty cycle to enable filter
FNTQ_RATEMUL	unitless	modifier to engine torque rise rate limit
FNTQ_RATEMAX	Nm/sec	engine torque rise rate limit
pps_rel_hyst	a/d cnts	accelerator pedal position (relative value of PP to foot off position)
vspd	mph	vehicle speed
novs	rpm/mph	ratio of engine speed / vehicle speed
spd_ratio	unitless	ratio of turbine speed / engine speed
tq_dd_unfil	Nm	filter input
tqe_dd_filt_tmp	Nm	filter output
tqe_dd_req	Nm	engine torque request (input) (based on pps_rel_hyst and vehicle speed in one example)
tqe_dd_filt	Nm	last pass filtered output

```
if (( app > -1 )                    /* At part pedal tipin */
     && ( bcsdc < tqe_rate_mndc )/* converter is not lock yet */
     && (tq_dd_unfil > tqe_dd_filt) ) /* increasing driver
demand request */
     {
     tqe_tipmx_tmp = lookup_3d(&fntq_ratemul, pps_rel_hyst,
vspd) * lookup_3d(&fntq_ratemax, novs, spd_ratio) ;
     tqe_arb_max = tqe_dd_filt + (tqe_tipmx_tmp * delta_sec_tmp)
; /* tipin rate */
     if (tqe_dd_filt_tmp > tqe_arb_max) /* Filtered DD greater
max */
          {
           tqe_dd_filt_tmp = tqe_arb_max ; /* Clip */
          }
           else
          {
           tqe_dd_filt_tmp = tq_dd_unfil;
          }
     else
     {
          tqe_dd_filt_tmp = tq_dd_unfil;
     }
```